DOCUMENT RESUME

ED 442 467 IR 020 308

AUTHOR Sage, Sara M.
TITLE The Learning and Teaching Experiences in an Online Problem-Based Learning Course.
PUB DATE 2000-04-25
NOTE 36p.; Poster presented at the Annual Meeting of the American Education Research Association (AERA) (New Orleans, LA, April 24-28, 2000).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Computer Uses in Education; Constructivism (Learning); Decision Making; *Distance Education; *Educational Technology; Graduate Study; Higher Education; *Instructional Design; Internet; Interviews; Models; *Problem Based Learning; Student Surveys; Teacher Education; Teacher Surveys
IDENTIFIERS Indiana University Bloomington; Learning Environments; Technology Integration

ABSTRACT

This paper describes and examines the experiences of eight learners and two teachers in an online distance education graduate course taught using an asynchronous program and a problem-based learning (PBL) pedagogy. The course, "Integrating the Internet across the Curriculum," was offered by Indiana University Bloomington as a 6-week summer course in 1999. As a World Wide Web-based course, it was available to a worldwide audience of K-12 educators in graduate or certification programs. The focus of the paper is on the general learning experience, particularly during the PBL portion of the course. The course was observed online, and additional information was obtained from students through e-mail questions and telephone interviews, and from the instructors through telephone interviews. Results are presented related to: the constructivist learning environment; individual learning and experience; group learning experiences; assessment and grading; developing an atmosphere of trust and collaboration; problem-solving student issues online; and design and implementation of PBL. Technology interface considerations related to these learning and teaching issues are outlined. A decision-making model for online PBL courses is presented that addresses student, teacher, curriculum, technology, and structural contextual issues. Contains 20 references. (MES)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 442 467

The Learning and Teaching Experiences in an Online Problem-Based Learning Course

Sara M. Sage

Indiana University South Bend

S.M. Sage

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
  Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

One of three papers presented in (structured poster) Session 12.02, *Problem-Based Learning in an Online Instructional Technology Course*, at the annual meeting of the American Educational Research Association, New Orleans, April 25, 2000

IR020308

BEST COPY AVAILABLE

The Learning and Teaching Experiences in an Online Problem-Based Learning Course

The purpose of this paper is to describe and examine the experiences of eight learners and two teachers in a six-week online, distance education graduate course, taught using an asynchronous program and a problem-based learning (PBL) pedagogy. This course, F500: *Integrating the Internet Across the Curriculum*, was offered by Indiana University Bloomington as a six-week summer course in 1999. As a Web-based course, it was available to a worldwide audience of K-12 educators in graduate or certification programs.

Problem-based learning is focused, experiential learning organized around the investigation and resolution of messy, authentic problems (Torp & Sage, 1998). PBL is both a curriculum organizer and an instructional strategy which:

- engages students as stakeholders in an *ill-structured* (messy, no one right answer) problem situation
- organizes curriculum around this problem, enabling student learning in relevant and connected ways
- creates a learning environment in which students are active learners and teachers are coaches of student thinking and inquiry, facilitating deeper levels of understanding

Teachers (or students) select a problem that is relevant to their students and linked to desired outcomes and develop a PBL unit in which they embed essential instruction and authentic assessments as integral parts of the problem-solving experience. Often teachers will use role and drama to engage learners in a real or simulated problem.

During problem implementation students:

- assume the role of a stakeholder in the problem scenario
- engage in an ill-structured problem situation
- define the problem
- gather and share information related to the problem situation
- generate several possible solutions and identify the solution of best fit

Problem-based learning is an exemplar of a learning environment based on constructivist learning

Figure 1: F500 Class Members

Class Members (Pseudonyms)	Background Information (from online personal introductions)
Debbie	Special education teacher (currently teaching)
Ann	Currently home-schooling her children; previous computer database work; not yet a certified teacher
Blanche	History teacher in Asia
Irene*	Re-certifying for secondary math, currently parenting four children and farming
Teresa*	Doctoral student; former middle school math teacher
Connie	Spanish teacher (currently teaching)
Nancy	Computer-assisted instruction facilitator for K-12 school district
Grace	Master's student in English as a Second Language Education

*participated in telephone interview after course

The rough syllabus for the course included one week of online readings and discussion, three weeks of work on a problem-based learning experience, and the remaining one and one-half weeks to for each class member to develop individually an Internet lesson project. The PBL unit was designed by the two instructors and was being implemented for the first time. In this problem, class members took the role of teachers in a fictitious school district, responding to a letter from Dr. Josh Smith, the fictitious superintendent, to develop a plan for technology integration in the district.

Learning and Teaching Issues

My main "lens" came from my experience in teaching and researching PBL in face-to-face classroom situations. I found many of the aspects of this course to be similar to face-to-face courses that use problem-based learning or other constructivist strategies. Of interest to me was not so much the online technology itself, but how doing PBL online affects the teaching and learning process. Therefore, I will be experimenting here with an alternative writing format in which I maintain a running text of learning and teaching issues on the right column of each page, and use the left column to outline the technology interface with these issues.

Learning (and Learner) Issues

Technology Interface Issues

The dual challenge for some students – that of taking an online course using ACT (Asynchronous Collaboration Tool) as well as experiencing constructivism for the first time – seemed quite onerous. Several mentioned "too much time and work for a three credit course." Going back through long threads of messages seemed "a waste of time" to many students:

> Teresa: I have mixed emotions right now. I feel that the process or writing, reading and responding is very time-consuming, much more so than in a real classroom discussing topics. Also, I find myself uncomfortable with not being able to see peoples' faces and expressions in regards to what they write. Just typing a :) doesn't feel the same to me.

1. Constructivist Learning Environment

One of the major issues for some learners in this class seemed to be almost unrelated to the online course experience, but came from their struggle with the learning experience in a constructivist course. If class members had never had a course in which they were expected to be active learners and problem solvers and the teachers expected to facilitators, they clearly floundered at first (Perkins, 1991; Sage, 2000). Several students clearly struggled with being immersed in a problem very early on in the course, and found wading their way through multiple resources, online group work, defining and conceptualizing the problem, and using past experience to be overwhelming at times. Irene, new to this type of learning environment:

> As a student, my role was to struggle to understand what was wanted and spend an incredible amount of time fulfilling the assignments, while Jamie and Chandra, toward the end, were like cheerleaders applauding our efforts and coaches pushing us on. This was a very new experience for me as usually the instructors were lecturers.

Teresa had more experience as a "constructivist" teacher and learner:

> I think it's nothing to do with age, I think it's to do with experience. And the experience is what's important, and how you move from the beginner in this kind of new way of learning, into feeling comfortable and not usually frustrated. So I could see some middle school students I've taught that would be much more confident and capable in the environment I had [in] this class than some of the students who were there, because they've experienced some kind of working in groups, working on meaningful tasks, working on your own to find a solution.

interview with the course instructors together, and one each with the individual instructors. Finally, the instructors provided me with their e-mails to each other during the course.

I used a constant comparative method, including first open coding and then axial coding (Strauss & Corbin, 1990) to review transcripts of interviews and other course communications. I identified common themes, as well as discrepancies, with regard to the online PBL course experience, by focusing on general learning and teaching issues and then more specifically on the PBL experience and the technology/online aspects.

The Teachers and Class Members in F500

The two course instructors, Chandra Hawley Orrill and Jamie Reaves Kirkley, were both doctoral students in Instructional Systems Technology when this six-week course was offered in May and June, 1999. Chandra and Jamie had each taught the course before, but had never co-taught it together. They were also long-term friends who had very similar teaching philosophies in terms of facilitating PBL:

> Chandra: I would define my role as somebody to keep them focused on what they're supposed to be doing . . . to make sure that they're thinking through things, and considering multiple perspectives, and considering different ways of doing things. . . I think another aspect of the job of the facilitator is to deal with problems [like] trying to deal with one group that was just not functioning at all. And then answering technical questions. My basic philosophy is that the technology shouldn't become a barrier to the learning, so if there's technology questions, just answer them point blank so that the students can get back to the learning.
>
> Jamie: Getting students to basically get their ideas out rather than just sort of looking at the first one and following on that. So - facilitating the process and promoting metacognition. And that means pushing them to explore, to consider other resources. And part of that is promoting research and getting on the Internet. With the Internet search tools being still somewhat difficult to use, we have to sometimes really push that.

The eight class members in this course (one additional student dropped the course about one week in) came from very diverse backgrounds and levels of experience with both teaching and with technology. Figure 2 gives a brief background of each class member. These individual differences become very important in the online course experience. Most registered for the course for certification, re-certification, or for personal learning regarding the use of technology in K-12 classrooms. All appreciated the asynchronous nature of this course so that they could be online whatever time of day or night was most convenient.

theory (Savery & Duffy, 1995). PBL has a history of several decades in medical education (Barrows & Tamblyn, 1980; Norman & Schmidt, 1992; Albanese & Mitchell, 1993), but has only more recently become a strategy used in teacher education (Sage, 2000).

Distance education is growing rapidly in various education arenas. The number of students attending web-based universities will more than triple by the turn of the century (Gubernick & Ebeling, 1997). This rapid rate of expansion at all levels has called for a renewed focus on understanding and improving online teaching and learning.

Distance learning environments often promote student engagement using collaborative problem solving and inquiry. Asynchronous conferencing is emerging as one tool that creates opportunities for online collaboration and problem solving. Social interaction is a key issue for students in web-based courses that use asynchronous communication to teach and learn. While the literature on computer-supported collaborative learning is substantial and growing (Koschmann, 1996), there is little research on students' problem solving processes using asynchronous conferencing tools. Research is just beginning on online PBL courses (Naidu & Olver, 1996; Corrent-Agostinho, Hedber, & Lefoe, 1998).

Research Study and Methodology

This paper is one of three looking at the same course with different foci and from different perspectives (the other two papers were written by the two course instructors). My focus is on the general learning experience, particularly during the PBL portion of the course. I "observed" the course online as well as obtained additional information from students through e-mailed questions and phone interviews, and from the instructors through telephone interviews.

All students in the course agreed (through voluntary participation for extra credit) to respond to my three e-mail prompts during the PBL portion of the course. In addition, two students agreed to participate in in-depth, semi-structured telephone interviews after the course. Both the prompts and the interview questions focused on students' experiences with the PBL portion of the course. The instructors provided me with copies of student journal responses required for the course. Additionally, I used the record of all students' postings and responses on the asynchronous conferencing tool to provide context. I conducted one telephone

Technology Interface Issues

The background students brought regarding online course technology also impacted their ability to "hit the ground running." It seemed that several of the students who did not have a strong teaching background also did not bring a background in online courses. For several students, learning the ACT system consumed most of their learning time in the course, leaving little "learning space" for considering issues of using the Internet in the classroom.

Easy and frequent access to a computer became a real issue in participation. Those people who were able to be online more frequently typically had a stronger "voice" in the ACT dialogue and often made proposals first, by clock time, which ended up being adopted by the class. This usually meant the

2. Individual Learning and Experience Issues

As in most graduate education courses, students' previous knowledge, skills and experience varied widely (Sage, 2000). Understanding basic teaching issues like curriculum, instruction, assessment, and school culture – as well as the actual content of technology in the classroom - was critical background knowledge for the PBL work in this class. One student, Nancy, was actually doing the kind of technology integration work in schools that the course was about. Other course members were not yet teachers, or teachers with minimal experience using technology and the Internet in the classroom. Several members apologized frequently on ACT as well as in private emails to the instructors about their lack of knowledge related to the problem, as well as to current educational terminology. For example, Chandra designed and posted a rubric for scoring students' work on the problem; however, several students were not familiar with the term "rubric."

The life situation of each class member during the six weeks of the course also made a big difference to their course experience. Several were teaching full-time (at the end of a school year), dealing with exams and report cards. This usually meant they could only access the course for a few minutes during the day, if at all, and so were typically only online in the evening in their time zone. One class member had to walk to a neighbor's home to use a computer – again, usually just once a day. Another class member traveled twice to another continent during the class. There was only one class member who, due to her work, had an office and had times available throughout

full-time teachers or busy stay-at-home moms were constantly "catching up."

The amount of similar responses to a post- each needing to be opened and read - became bulky and burdensome to many students. Ann commented:

> I am somewhat frustrated with the folks who keep saying "this is so confusing" because they are adding to the number of messages. . . I'm basically trying to be patient with the people who are new to this system, because it is very confusing at first (I would have hated for my first year on usenet to actually "count" for anything!!), and waiting until more substantive discussion is underway.

When class members adopted the suggestion of another class member of putting "NT" (for "no text") in their subject headings when appropriate, this problem seemed to ease.

most days and evenings to frequently access ACT.

Finally, differences in learning styles seemed to have a strong effect upon students' individual experiences. Assertiveness comes across somewhat differently online than in person; for example, the person online first with a suggestion often became, by default, the "leader." In face-to-face class discussions, introverted students, who may need more thinking time before they speak (Myers & McCaulley, 1985), often see their thoughts and points "taken" first by someone else. This effect is somewhat mediated in an asynchronous online environment where, theoretically, everyone has more thinking time before they respond. However, several students shared the concern Irene did:

> We certainly don't have equal footing because those who have more experience and access tend to dominate the discussion. It's difficult to get in because they are saying everything and you don't want to be repetitive; it's hard enough to sort through.

Several of the "frequent contributing" students were very frustrated at the "slow" pace they saw during the first several weeks; they mentioned being "can-do" people who wanted to attack and solve the problem, and were frustrated with other class members confused either with the content, the PBL process, or with the ACT technology. Others felt the course moved so quickly that they could not keep up with the large number of posts each day. Grace, the international student in the class was concerned:

> Actually, I was overwhelmed by positive participants and much information from them . . .[I} do not speak fluently [sic] English like other classmates in the class. Moreover, I don't have any teaching experience, which made me demotivation [sic]. Whenever they exchanged and suggested their opinions related to teaching experiences, I felt that I didn't contribute anythings [sic].

Technology Interface Issues

Almost all class members expressed a desire to have a chat tool to work with so they could communicate in synchronous dialogue with their fellow small group members.

One interesting issue in this group's difficulties was that they had trouble getting online at the same time to have as much of a synchronous dialogue as they could. They frequently tried to word smith and problem solve using subject line conversations:

Response **It's here but it is a mess didn't copy well** *(Connie 9:50 pm)*
Response **Looks good to me!** *(Irene 9:51 pm)*
Recommendation **also leave assessment as is** (nt) *(Irene 9:52 pm)*
Recommendation **I suggest in the learning section that we lead off with yours** *(Connie 9:53 pm)*
Response **I don't know that a survey is part of our job description though**. (nt) *(Irene 9:57 pm)*

3. Group Learning Experiences

Class members began the PBL experience by working together as a large group to conduct inquiry on school district technology issues. As previously mentioned, students found this process of large group problem solving on ACT difficult. They lobbied the instructors to divide up into smaller groups to focus on different aspects of the problem. The instructors agreed and divided students into groups primarily based on the interest the students expressed. Because this happened early in a short-term course, it was difficult to be able to heterogeneously group class members.

The three groups, originally divided to have three class members each, ended up as three-three-two when one class member dropped out. The group of two – Connie and Irene –struggled with some serious communication difficulties. Neither had a strong background in technology issues, and they had very different philosophies about their topic in the problem – professional development. Each felt the other had dropped the ball:

Irene: My group never "connected." I did everything on my own and now the recommendation is entirely different than what I suggested. . . We did resort to using the phone and emailed frequently. I guess a lot of the phone conversation was about not exactly knowing what we were supposed to do.

Connie: It is always interesting to work as a group. The problem which I encountered in this session was that I worked with someone who really did not have the time to give to this class as she has a large farm.

BEST COPY AVAILABLE

Technology Interface Issues

Often students in this class – most novices at online courses – were uncertain about how and how frequently to contribute:

Grace: Sometimes I feel like I want to add a small comments like one might do in conversation, but in this type of forum, such small talk can provide 'threads' which might carry on and draw focus from the main topic . . . It is important for teachers to keep the discussion in focus and on task. I think that our discussion needs focusing [sic] the topic, and frequently, it seems like an answering machine or chatting room [sic].

Access remained a participation/grading concern as well. One student who did not have a computer at home commented:

When people are conversing [online], you never know when they're going to come on and do that. It almost feels like I would get behind in the conversation and then have to read up and try to add to it, because it is a participation grade. Often I was on late at night, 11:00 to 12:00.

4. Assessment and grading issues

Participation – and grading based on participation – becomes a very different issue in an online course. The only "visible" way to participate is to post messages. Students had different views about how participation would be viewed by the instructors. Some acted as if the sheer number of contributions would be graded, even responses like "yes" or "I agree". More experienced online students in the course viewed these responses as distracting and as violating "Netiquette."

Blanche: One student posted "Assessment," "Assessment #6", and "Assessment issues", which were all nearly identical. Moreover, there was practically verbatim information from a Web site. With so much material to go through, it seems it would be more effective if the site addresses were posted with brief summaries. It would be uncomfortable for me to suggest this to a fellow student, though, when she is clearly trying hard.

A number of students were uncomfortable with the group grade involved in their joint work on the response to Dr. Smith in the PBL portion of the class. Irene commented: "If the grading is done by participation, which it would have to be in a group project, it feels quite threatening." Chandra and Jamie included peer evaluation in the final scores for the PBL experience. In the group in which a good deal of conflict occurred, one member rated the other with high scores, while the other rated her partner with some of the lowest scores. Again, this type of group conflict over equity of contributions could easily occur in a face-to-face classroom environment.

Teaching Issues

Technology Interface Issues

One issue related to trust and collaboration that came up again and again from both students and the instructors was the difficulty in not having nonverbal cues in an online situation. In a face-to-face two-person conversation, more than 65 % of the social meaning of the situation is carried by nonverbal messages (Johnson, 1997).

One of the online issues in terms of facilitation Jamie and Chandra recognized was the "weight" their words carried online:

Jamie: Chandra and I have done some research with an online teacher at IU who has impacted the way we do online. She talked about when she first started teaching, that when she would speak up too early, students would sort of all flock to her viewpoint, rather than proving their own. So that's something Chandra and I are careful not to do until it's necessary or purposely later in the process if we want to provide another perspective.

1. Developing an atmosphere of trust and collaboration

There are a number of ways trust and support must be deliberately developed to balance the challenges in a problem-based, constructivist, learning environment (Sage & Torp, 1997; Sage, 2000). When learners construct their own meaning and therefore have more responsibility for their own learning, they must be able to trust themselves, others in the class, and the instructors. The instructors must also trust themselves (and each other, if co-teaching), their students, and the process of problem-based learning, even when students are frustrated.

Establishing this sense of trust can be done in particular ways in face-to-face classes, such as by a warm and friendly teaching style, providing snacks, encouraging students to interact with each other, and by being very encouraging toward students' initial efforts. Online environments make establishing this sense of trust a little more difficult because of the lack of non-verbal information and, in this case, real time dialogue.

However, the biggest challenge for this course was the short time frame. Normally the course is taught over a 16-week semester. In a six-week time span, it was not possible to spend a lot of time "trust-building" before diving into the PBL process, which required almost immediate group collaboration from the students. It also allowed very little time for Chandra and Jamie to get to know the students and to determine how to divide them into groups that would function well. When one group had serious difficulties, Chandra said:

Chandra: And in this case, because we knew that we had a particular perspective about professional development in particular that we didn't want to foist upon the students, we provided them with an outside resource – a consultant they could ask questions of, who we knew would bring in the same kinds of perspectives we have. Jamie and I were afraid if we put in those particular comments, the students would have said, Oh, this is the direction that they want us to be going.

Of course, the same issue of students "flocking" to the instructor's view could happen in a face-to-face situation as well. But without other ways to balance power in the learning experience, such as non-verbals like voice tone, proximity, etc., this can be a real issue for online constructivist environments.

When we taught this class before we had them do a lot of work together online before they have to do this one group project together. But this one they got thrown in the second week so they didn't know anything about each other. It may be that if we had gone longer and gotten to know them better that we wouldn't have put them together in the first place.

They did use several strategies to encourage students to trust themselves, each other, and the process:

Chandra: Jamie told me that something she had been really successful with was giving a lot of positive feedback. For people who weren't talking a lot, say things to them that were very flattering and very positive to try to bring them in, like "The insights that you have given us so far have been great. We would like to see more of it," or something to that extent.

It was clear that the instructors trusted each other, and the PBL process. Although the two instructors co-planned the course, Chandra had taken the lead on designing a new problem for this class.

Jamie: So especially using a new problem, I wasn't sure – were students really going to head this way, or are they going to go off on a new path and take an entirely different direction? It sort of reaffirms my faith in problem-based learning that students end up doing lots of critical thinking and figuring out what the important things are, so I think it's trusting that process.

When Chandra lost power and phone lines for several days during the course due to a severe storm in her area, she commented:

I could say, Jamie, I can't do this, and I didn't sit around thinking, Oh, is she going to tell them this? Or, Oh, is she going to tell them that? I just knew that she would go with it, and when I got back on, I would just hit the ground, and we'd keep moving forward.

Technology Interface Issues

A conversation during my joint interview with Chandra and Jamie summarizes a gap between this online course tool and this class' needs:

Chandra: There's no synchronous – this is a limitation of the particular tool we're using. They need to have a synchronous way to do quick talking. When they want to have a team meeting, they need to be able to do it without having to constantly reload the page.

Jamie: And that's really important for team production issues, like who's going to review the draft, when it's just having a 3-day delay on doing that, where they've lost all that time – they could get on chat and figure those issues out in probably a 15-20 minute conversation.

Chandra: It would be much more like using a telephone.

Sara: Right. The absence of a chat tool being a problem was one of the big themes that came out of the student interviews as well.

Chandra: Yeah, I would agree with them – that was a huge issue, more with this class than any other class that I've done, though. I mean, the rest of them have all been able to deal with that, and this class just – they

2. Problem-solving student issues online

Although the instructors modeled collaboration and trust successfully, the students had more difficulty. One team in particular struggled with quite serious interpersonal conflict, mostly due to a posting of "agreed" wording by one member that another member felt ignored her point of view.

> Chandra: Within 24 hours of each other they both sent us e-mails that looked almost identical to each other, saying, "My team isn't working. I'm having to do everything. My partner has disappeared." Blah blah blah. And if it wasn't so sad that they were having this problem, it would have been really funny because their e-mails were almost identical, word for word. But the fact that they were both saying that about the other person made it very hard for us to sort through what to do.

Jamie and Chandra encouraged each student to talk with the other to communicate more clearly about their concerns, which they did in a telephone call.

Again, this type of conflict could arise in a face-to-face class. However, the difficulty over whose wording would be used publicly might not be the issue there, as it was online. Neither instructor had ever dealt with such a serious difference of opinion in a group before. Both mentioned having less group difficulty in online classes typically, because posting messages electronically forces you to think more carefully about what you say. However, as Jamie pointed out, it may also make people more hesitant to contribute:

Jamie: Chandra and I want to treat it more like a discussion tool, but because it is print – I mean, print just seems more permanent, I think there are issues that students may at times be hesitant to speak up. For example, I'll get students who email me and ask, Am I doing this right? Or they have a question about the course, when I would much prefer them just to post it there. But I think they have some fear of looking stupid because they don't know something.

needed it so bad. And as the instructor, I felt very helpless, because I didn't know what to do to help them.

Jamie: We have issues with getting access to chat tools. I have investigated this, and it's because of the Mac/PC platform and getting things where other people won't join your chat. I talked to other instructors, and that's been problematic, so I've been hesitant about using tools where other people can just show up.

Technology Interface Issues

The varying experience and skill students brought in terms of searching for appropriate resources on the Internet was a factor. In addition, some students seemed to consider the Internet the only place to look for resources – rather than drawing upon their own experience, or particularly considering the context of the problem Chandra designed. I was surprised students

One thing the instructors learned to do was to be "incredibly specific":

Jamie: One student made the comment, "I'm a day behind when you post the assignment" because of where she's located. So you have to deal with issues of that. And I think there's some stress with that sometimes, depending on what time zone their group members are in.

Chandra: What I've gotten very explicit about doing is, when there's a due date, you say, 5:00 p.m. Eastern Standard Time, or 5:00 p.m. Central Time, because otherwise if you say 5:00, then people say, Is that 5:00 my time or 5:00 your time?

It is impossible to say whether or not this group conflict would have still occurred had a chat tool been part of the course. However, in this type of problem, where students must work closely together to present specific wording, some sort of chat or other synchronous component seems necessary.

3. Design and implementation of PBL

The instructors face many challenges in designing problems for an education course. Some of the students are experienced teachers, others working toward certification, some have a great deal of experience using technology, and some don't. The instructors had to consider what type of problem situation would help class members learn about important technology issues in K-12 school districts that are different than technology issues in higher education. Chandra and Jamie decided in this case to develop a new (simulated) problem for this class, in which class members took on the role of being teachers in the same school district, asked by their superintendent to help develop a technology plan for the district. This was different than a previous problem used in the course in which teachers acted as consultants (thus outsiders rather than insiders) to a district.

did not ask for more information from "Josh Smith" about the district. Of course, if they were really teachers there, they would know. This can be a thorny issue in a fictitious problem.

The hierarchical conference structure in ACT (Duffy, Duber, & Hawley, 1998) did appear to keep students focused on a problem-solving process rather than simply an unstructured dialogue. However, the effective use of the hierarchy depends a great deal on the skill and knowledge of the user. Several students mentioned being confused by someone responding "under" one line when they thought the response was really more appropriate to be tagged to another response. This meant more reading and searching by students.

One of the most difficult issues the instructors faced in this problem was keeping students "in role." PBL teachers, if placing students in a role outside of themselves, help move students to a level of role playing that intimately involves them in the problem as insiders, so students own the problem and have more investment in solving it (Torp & Sage, 1998).

> Chandra: They were treating it like it was an assignment in a class, and not like they were teachers in the district. And that's really haunted me since we finished with the course. What could we do to help them buy into that role more, so that they know when we're talking about curriculum change, we're talking about **us**, we're not talking about **them**. They kept talking about the teachers in the third person, and the district as a very remote, made-up place.

Jamie reiterated the difficulties of decided how contrived a problem should be in teacher education. We discussed the differences between this type of PBL and the medical model of PBL, in which students use cases derived from real patients, where context may not always be quite as critical, or the business school model, in which students typically work on real problems with real organizations. Chandra mentioned that when teachers are embedded in a particular school organization, they have difficulty suspending what they know about their own organization to "step into" another organization.

One thing the instructors agreed went well was the way they had structured and planned the learning activities in the problem. They set up the calendar for the course so that students had due dates for different problem-solving components in a particular order: brainstorming first, then reading (both resources from supplied Web sites and resources students found on their own), then working as small groups to create different parts of the final technology plan.

Conclusions

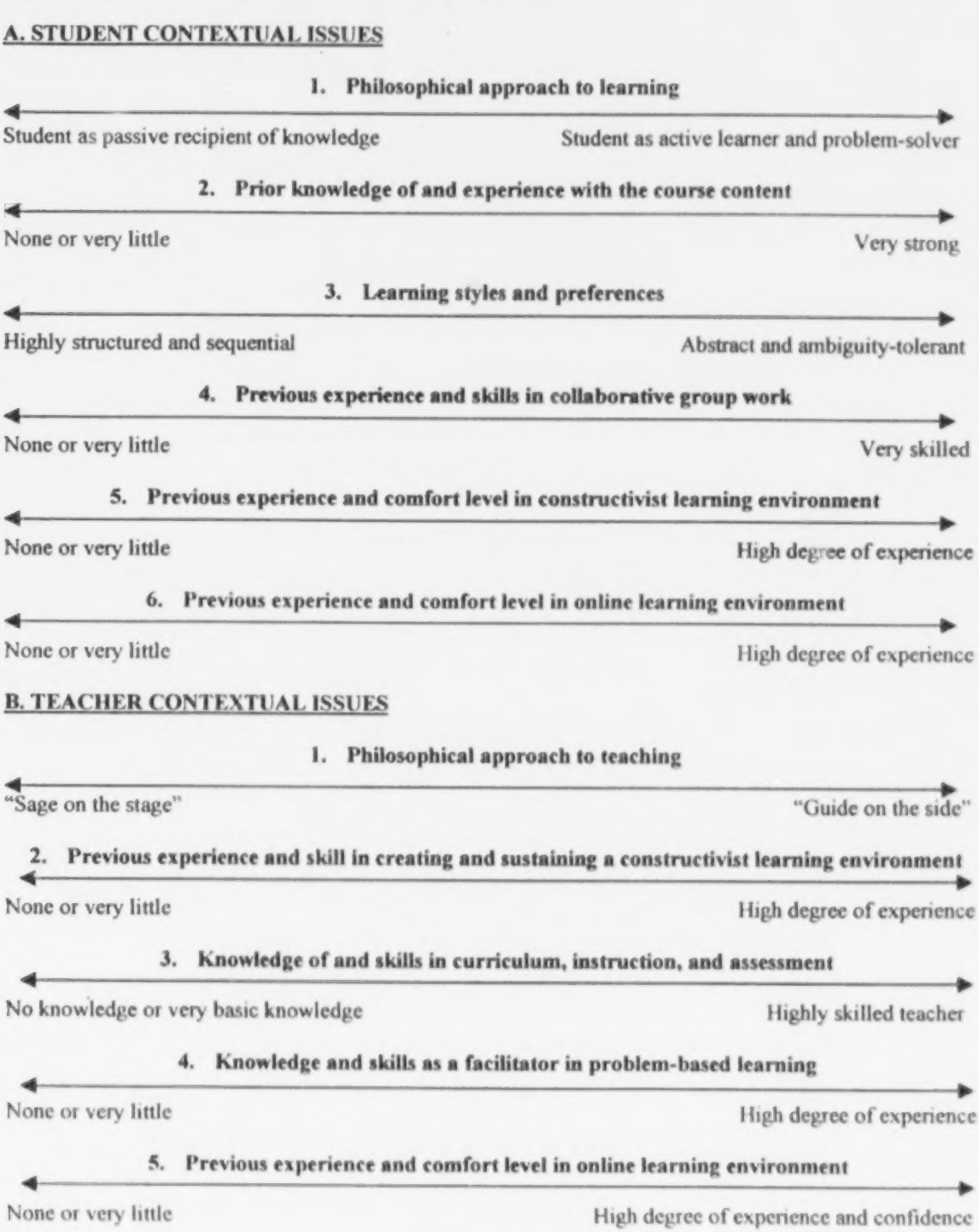
There are many interrelated factors that are part of any educational experience – whether face-to-face or online. Because these factors are so contextual, it is difficult to come to specific conclusions or recommendations that would apply in any online PBL course. The course described in this paper is one unique context; others writing about online PBL courses may be describing very different contexts. However, issues may very much overlap in different contexts. Perhaps there is a need for differentiated forms of online PBL for various contexts.

Using Carol Tomlinson's (1999) conception of an "equalizer" (with regard to differentiated instruction) as a visual structure, there can also be a model for the various ways an online PBL course could be structured to best suit a variety of contexts. I am experimenting here with some of the variables that affect the planning, implementation, and assessment of an online PBL course. I am proposing five main sets of contextual issues: (1) student, (2) teacher, (3) curriculum, (4) technology, and (5) structural. I present each issue as a continuum, along which contextual factors may be situated, and may vary widely. Situating a particular course along these continuums may help us determine the type of online environment and the type of PBL that is most appropriate for the course.

In this model, my general assumption is that the left half of each continuum contains contextual issues that make online PBL more difficult; while the right half of each continuum contains more "ideal" contexts for online PBL. However, some items such as A3 may be neutral – simple differences that impact online PBL but are value-free. In addition, some items are unchangeable (e.g. some characteristics of teachers and learners, or perhaps the size of the class). My contention is simply that a large number of items on the left for an online PBL course will make it a very challenging situation, and will require a great deal of support so that learners or instructors don't simply "shut down" (Perkins, 1991).

Additionally, the first three categories (student, teacher, and structure) are somewhat of a "given" at the time of any particular course. Based on these three contextual factors, as well as the first two items in curriculum – content and difficulty – we may choose to vary the type of PBL we select, as well as the type of online course tool that best fit that type of PBL.

Figure 2: Decision-Making Model for Online PBL Courses


A. STUDENT CONTEXTUAL ISSUES
1. Philosophical approach to learning
Student as passive recipient of knowledge
Student as active learner and problem-solver
2. Prior knowledge of and experience with the course content
None or very little
Very strong
3. Learning styles and preferences
Highly structured and sequential
Abstract and ambiguity-tolerant
4. Previous experience and skills in collaborative group work
None or very little
Very skilled
5. Previous experience and comfort level in constructivist learning environment
None or very little
High degree of experience
6. Previous experience and comfort level in online learning environment
None or very little
High degree of experience
B. TEACHER CONTEXTUAL ISSUES
1. Philosophical approach to teaching
"Sage on the stage"
"Guide on the side"
2. Previous experience and skill in creating and sustaining a constructivist learning environment
None or very little
High degree of experience
3. Knowledge of and skills in curriculum, instruction, and assessment
No knowledge or very basic knowledge
Highly skilled teacher
4. Knowledge and skills as a facilitator in problem-based learning
None or very little
High degree of experience
5. Previous experience and comfort level in online learning environment
None or very little
High degree of experience and confidence

C. CURRICULUM CONTEXTUAL ISSUES

1. Nature of content

Theoretical/abstract ⟷ Immediately applicable to the "real" world

2. Level of complexity and difficulty of course concepts

Complex/advanced ⟷ Simple/basic

3. Degree of "ill-structuredness" in problem(s) selected for course

High ⟷ Low

4. Type of problem situation

Real problem (no simulated aspects) ⟷ Simulation or fictitious situation

5. Amount of resources provided by instructor

Few or none ⟷ Most or all

6. Amount of concepts expected for students to learn in course

Many ⟷ Few

D. TECHNOLOGY CONTEXTUAL ISSUES

* obviously availability of various programs so that instructors have choice is significant here. Some instructors may realistically have just one program available on their campus, in which case they must design PBL experiences around this program or "force fit" PBL to the program. My contention, as a non-expert in instructional technology, is that tools that allow for both synchronous and asynchronous environments, as well as containing specific features for collaborative problem solving, are best for PBL.

1. Type of program/tool used for online course

Asynchronous only or synchronous only ⟷ Both synchronous and asynchronous

2. Capabilities/design of program for group problem solving

None or little ⟷ High

3. Access issues for students and teachers

Very limited or unreliable access ⟷ Convenient, reliable access

4. Support for online program used in course

None or very little ⟷ High degree of accessible, quality support

E. STRUCTURAL CONTEXTUAL ISSUES

1. Number of students in course

Large class ⟷ Small group

2. Length of course

Short/condensed ⟷ Full semester or ongoing

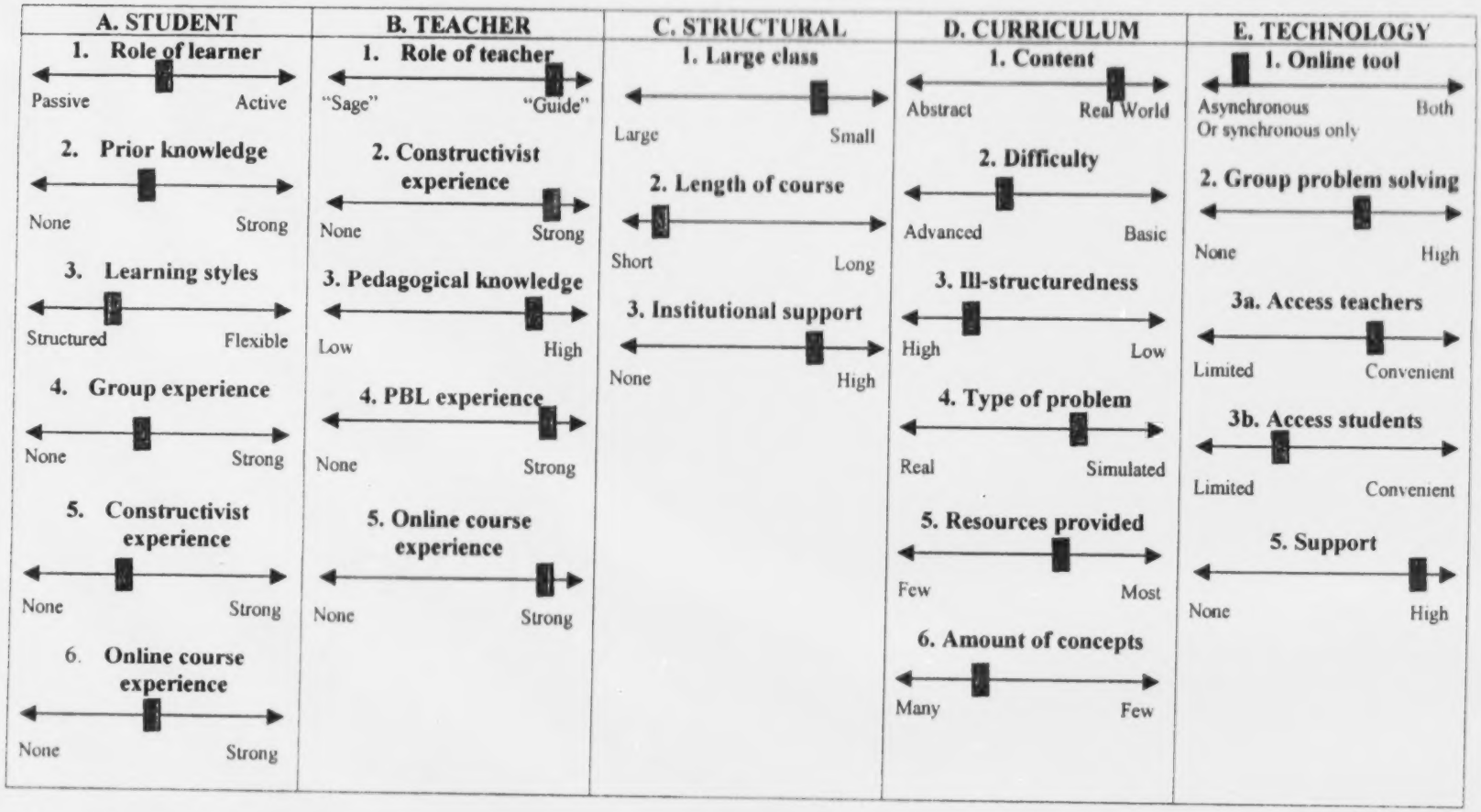
3. Institutional support for online PBL

Little or none ⟷ High degree of support

Adapted from Tomlinson (1999)

Placing my impressions of this online PBL course on the model would create the course portrait represented in Figure 3.

Figure 3: Model for Online PBL in F500



Adapted from Tomlinson (1999)

As the model visually displays, the strength and best supports in this class were the teachers, both of whom were highly skilled and experienced in a constructivist online learning environment. They also designed an appropriate problem for this course, in terms of using a very practical, real-life teaching situation that was simulated (so it was more contained), as well as providing a number of resources for students. This was important in such a short-term class. However, some difficulty came from the fact that this was a very short-term course in which not only was there little time to build trust and community before the problem started, but also little time for students to read, think, and problem-solve together in what was quite a complex problem. In short classes, a more structured or smaller scale problem may be more appropriate.

Technology issues also were somewhat difficult in that ACT, while is does provide structure for asynchronous problem solving (Duffy, Dueber & Hawley, 1998), did not allow students to have synchronous communication. Synchronous discussions were clearly important to discuss and "wordsmith" the response to Dr. Smith. Several students had access issues that made collaborative work difficult, and most were so busy while taking the course that they realistically did not have the time to devote to such active problem solving. Several students ended up having telephone conversations at some point during the PBL portion of the class so their group could agree on the wording of their portion of the statement. However, the fact that Chandra helped develop and create the ACT system also allowed students to make fullest use of its capabilities. Most instructors would not be so familiar with, or able to actually tinker with, the online course tool they were using.

Quite a few students had never experienced either an online or a constructivist course before. This challenge was effectively mediated by the skill and experience of the two instructors. Chandra and Jamie were able to "scaffold" the experience for the learners so that they could deal with the complexity of the problem and the task management involved (Perkins, 1991). However, some students had several or all of these significant challenges: (1) no experience in online courses or other online environments; (2) limited access and/or time for the course; (3) no or little background in a constructivist learning environment; (4) no or little K-12 teaching experience; or (5) no or little experience with the use of technology in K-12 settings, and thus the practical issues involved in technology integration in American schools. For students who had

several of these challenges, this course may have stretched them far past their own "zones of proximal development" (Vygotsky, 1978), in which they could appropriately stretch and learn. Perkins (1991) encourages us to envision how students experience the constructivist pedagogies we select. It may be that some students are not prepared to deal with the combination of PBL and online pedagogies – if both are new to them – and may simply shut down. Given that students in online courses may have even more diverse backgrounds than students in face-to-face courses on one campus, these are important issues to continue to consider.

However, in considering these issues, I see several primary weaknesses in the model I am proposing: (1) the lack of multiple courses in varied situations on which to base these categories; (2) the number of items in the model [24], which may make it too complex to be readily helpful; and (3) the difficulty in obtaining data about student contextual issues when planning a course; and (4) the lack of a defined and specific relationship among various parts of the model. For example, if we vary the curriculum, how does that affect the students and teacher? Or, if we have a certain profile of students, how do we determine what type of technology to use? Additionally, we must reconsider the way courses are designed, set up, scheduled, and staffed in higher education. This entire system is still typically based on the assumption that courses will be face-to-face and lecture-based. In this course, two instructors were helpful - even with only eight students - because of the extreme challenge to the learners in this short, intense course.

Finally, a number of issues more specifically relate to the relationship between the type of PBL selected and the type of technology tool best suited to it. We must look more carefully at different types of PBL, as Barrows (1986) has already done and perhaps update that list in terms of PBL in other professions and in distance education. We must also examine the online course tools that are available in terms of the features that support or do not support various forms of problem-based learning, or other collaborative problem solving strategies (Firdyiwek, 1999). I believe PBL would be best suited to a flexible and broad online course tool that includes features such as both synchronous and asynchronous communication, structures within asynchronous communication that are focused on problem solving, and relative ease of use

I look forward to dialogue and feedback on these issues.

References

Albanese, M.A. & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. Academic Medicine, 68(1), 52-81.

Barrows, H. (1986). A taxonomy of problem-based learning methods. Medical Education, 20, 481-486.

Barrows, H.S. & Tamblyn, R.M. (1980). Problem-based learning: An approach to medical education. New York: Springer.

Corrent-Agostinho, S., Hedber, J. & Lefoe, G. (1998). Constructing problems in a Web-based learning environment. Educational Media International, 35(3), 173-180.

Duffy, T.M., Dueber, B. & Hawley, C.L. (1998). Critical thinking in a distributed environment: A pedagogical base for the design of conferencing systems. In C.J. Bonk & K.S. King (Eds.), Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse (pp. 51-78). Mahwah, NJ: Lawrence Erlbaum Associates.

Firdyiwek, Y. (1999). Web-based courseware tools: Where is the pedagogy? Educational Technology, 39(1), 29-34.

Gubernick, L. & Ebeling, A. (1997, June 16). I got my degree through e-mail. Forbes, 159(12), 84-92.

Johnson, D.W. (1997). Reaching out: Interpersonal effectiveness and self-actualization (6th ed.). Boston: Allyn and Bacon.

Koschmann, T. (Ed.) (1996). CSCL: Theory and practice of an emerging paradigm. Mahwah, NJ: Lawrence Erlbaum Associates.

Myers, I.B. & McCaulley, M.H. (1985). A Guide to the Development and Use of the MBTI: A Manual. Gainesville, FL: Center for the Application of Psychological Type.

Naidu, S. & Olver, M. (1996). Computer-supported collaborative problem-based learning: An instructional design architecture for virtual learning in nursing education. Journal of Distance Education, XI(2), 1-22.

Norman, G.R. & Schmidt, H.G. (1992). The psychological basis of problem-based learning: A review of the evidence. Academic Medicine, 67(9): 557-65.

Perkins, D. (1991). What constructivism demands of the learner. Educational Technology, 31(9), 19-21.

Sage, S.M. (2000). Using PBL to teach PBL in graduate teacher education. Manuscript in process.

Sage, S.M. & Torp, L.T. (1997). What does it take to become a teacher of problem-based learning? Journal of Staff Development, 18(4), 32-36.

Savery, J.R. & Duffy, T.M. (1995). Problem-based learning: An instructional model and its constructivist framework. Educational Technology, 35(5), 31-35.

Strauss, A. & Corbin, J. (1990). Basics of qualitative research. Newbury Park, CA: Sage.

Tomlinson, C. (1999). The differentiated classroom: Responding to the needs of all learners. Alexandria, VA: Association for Supervision and Curriculum Development.

Torp, L.T. & Sage, S.M. (1998). Problems as possibilities: Problem-based learning for K-12 education. Alexandria, VA: ASCD.

Vygotsky, L. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.